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NORTH CAROLINA GEOLOGICAL SURVEY.

J. A. HOLMES, STATE GEOLOGIST.

BIENNIAL REPORT

OF THE

STATE GEOLOGIST

1901-1902

RALEIGH:
E. M. UZZELL & CO., STATE PRINTERS AND BINDERS.
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GEOLOGICAL BOARD.

GOVERNOR C. B. AYCOCK, *ex officio Chairman*, . . .	Raleigh.
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CHARLES MCNAMEE, ...	Asheville.
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LETTER OF TRANSMITTAL.

NORTH CAROLINA GEOLOGICAL SURVEY,

RALEIGH, N. C., December 10, 1902.

To His Excellency, GOVERNOR CHARLES B. AYCOCK,
Raleigh, N. C.

SIR:—I herewith submit for your consideration and approval the administrative biennial report of the State Geologist for the two years ending November 30, 1902. The work of the Survey during this period has embraced a variety of investigations, all of which relate to the industrial life of the Commonwealth, and relative to each of which special reports will be published at an early date.

Already large investments have been made in industrial enterprises as a result of the investigations conducted by the Survey, and now, as the publications embodying these results are being distributed in different countries, these investments will continue to increase.

With full appreciation of your continued interest and support in this work, I beg to remain, Yours obediently,

J. A. HOLMES,
State Geologist.

BIENNIAL REPORT OF THE STATE GEOLOGIST ON THE OPERATIONS OF THE GEOLOGICAL SURVEY OF NORTH CAROLINA DURING THE TWO YEARS ENDING NOVEMBER 30, 1902.

By J. A. Holmes, State Geologist.

MISCELLANEOUS MINERAL RESOURCES.

An investigation into the miscellaneous mineral resources of the State has been continued during the year by Dr. J. H. Pratt, the Mineralogist of the State Survey. These examinations have been distributed through nearly all the mountain counties and they have also extended through a number of the Piedmont and midland counties. The general purpose of this work is, as far as may be possible, to determine the specific distribution of each species of mineral found in the State, the extent, mode of occurrence and value of each such mineral deposit. It is expected that a report of 300 to 400 pages embodying the results of these investigations will be ready for publication toward the end of the year 1903.

The chemical work of the Survey during the year has not been extensive, but such analyses of ores and minerals as have been found necessary have been made by Dr. Charles Baskerville, in the chemical laboratory of the University, and by the chemist of the Department of Agriculture at Raleigh.

WATER-POWER INVESTIGATIONS.

The water-power investigations have been continued during the year on much the same basis as during the past several years; the United States Geological Survey co-operating with the State Survey in all of the general examinations. Stations at which are made daily measurements as to the height of the water in the streams have been maintained during the year on the Roanoke river at Neals, on the Cape Fear river at Fayetteville, on the Yadkin river at Salisbury

and Siloam, on the Catawba river near Morganton and at Catawba Station, on the Broad river near the South Carolina line, on the French Broad river at Asheville, on the Tuckaseegee river at Bryson City, on the Little Tennessee river at Judson, on the Hiawassee river at Murphy, and on several of the smaller mountain streams. The observers who make the daily measurements at each of these stations are paid largely by the United States Geological Survey, but the results are turned over to the State Survey. All of these measurements are made under the general supervision of Mr. E. W. Myers, the engineer of the State Survey, who also makes at intervals of once every month or every two months careful measurements with electric meters of the flow and volume of water at each of these stations. This work makes it possible for us to calculate with approximate accuracy the amount of water-power in each of these streams on each day during the year for one foot of fall. Measurements of the amount of fall at different points in each of these important streams make it possible to determine with approximate accuracy the amount of water-power which can be developed on each of these streams.

SOIL EXAMINATIONS.

The investigation of the soils of the State is in a measure a geological problem, inasmuch as the soils themselves are geological products, and they are being examined in their relations to the rocks from which they were formed. A systematic examination of these soils was begun during the year 1900 through an arrangement of cooperation between the State Geological Survey, the State Department of Agriculture and United States Bureau of Soils; the purpose of this investigation by the Geological Survey being to determine the origin, character and variations in the soil in different parts of the State, with a view to enabling the Agricultural Department to determine through its agricultural experiments the best methods of fertilizing and otherwise improving the soils and to discover the crops to which they are best suited. I regard these examinations as the most important that have been inaugurated in the State, and I believe that the results of these investigations will prove of inestimable and permanent value. It was considered highly desirable that these soil investigations should begin in the eastern coun-

ties of the State, for the reason that the soils in that region are more uniform in character and distribution, and consequently the results obtained are more extensive in their application. But the difficulty met with in beginning the investigations in that region was the lack of accurate maps. These maps were found to be necessary not only for the soil examinations, but also for determining the boundaries of the different character of soils, the possibilities of drainage, irrigation, etc. Consequently an arrangement was made between the United States Geological Survey and the Department of Agriculture by which careful surveys of the eastern counties of the State should be made. This work has progressed during the past year in an eminently satisfactory manner, and arrangements have been made to continue it during the coming year.

ROAD-BUILDING INVESTIGATIONS.

In connection with the investigation of the road materials of the State a considerable amount of attention has been given to the general subject of improved road-building in North Carolina. Meetings have been arranged at a number of the county-seats and addresses have been given there by the State Geologist. In connection with the good-roads movement in North Carolina it is worthy of mention that the Southern Railway good-roads train spent several days at Winston-Salem during the first week in November, and during the following week spent several days in the vicinity of Asheville, in both these places building a sample macadam road and holding a good-roads convention, which in each case was largely attended. These and other good-roads meetings held in the State during the past year have undoubtedly exercised a decidedly beneficial influence in promoting the movement for better public highways.

FORESTS OF THE SOUTHERN APPALACHIAN MOUNTAINS.

The forest and timber investigations have been carried on during the year through a co-operative arrangement between the State Geological Survey, the Government Forestry Bureau and the Government Geological Survey. Mr. W. W. Ashe, the forester and timber expert of the State Geological Survey, has completed his investigation into the pine forests of the eastern counties and his report embodying

the results of his axaminations will be ready for publication during the next summer season. His expenses, and during a portion of his time, his salary were paid by the United States Department of Agriculture. During a portion of the year he has co-operated in the investigation of the hardwood forests of the mountain counties. This latter investigation, however, has been done largely by Mr. H. B. Ayres of the United States Geological Survey, they paying his salary, while the State Geological Survey has paid the larger part of his field expenses. This investigation into the forest condition of the western counties has been carried on mainly in connection with the movement for the establishment of a National Forest Reserve in the mountain counties of Western North Carolina and adjacent States, and the immediate results of the investigation have been turned over to the United States Department of Agriculture and embodied in a report by the Secretary of Agriculture, which will be transmitted to Congress at an early date.

It should be added in this connection that with a view to making the above-mentioned report as complete as practicable, the investigation into the geology, topography and general hydrographic conditions in the Southern Appalachian mountain region has been continued during portions of the past year by the United States Geological Survey, co-operating with the State Survey, and during the months of July and August the special photographer of the United States Forestry Bureau was sent to North Carolina to co-operate with Mr. Ashe of this Survey in securing an elaborate series of photographs illustrative of the forests and agricultural conditions in the Southern Appalachian region and mainly in Western North Carolina.

In the investigation of the general natural history resources of the State a study of the miscellaneous botanical resources of the mountain counties has been inaugurated during the year under Mr. George F. Atkinson, Professor of Botany in Cornell University. Mr. Atkinson spent portions of the months of July, August and September in Watauga, Mitchell and Yancey counties making examinations and collecting materials for his report. He was assisted in this work by Dr. E. J. Durand. The arrangement made with both Professor Atkinson and Dr. Durand was that their expenses should be paid by

the Survey, but they receive no compensation except sufficient to cover their necessary traveling expenses. Of the specimens collected by them, one set goes to Cornell University and all other collections come to the State Geological Survey.

GEOLOGY OF THE MOUNTAIN COUNTIES.

The investigation into the general economic geology of the mountain counties has been continued during the past two years on a basis of co-operation between the United States Geological Survey and the State Survey. The field work has been done mainly by Mr. Arthur Keith and Mr. H. S. Gale of the United States Geological Survey, and by Dr. J. H. Pratt and the State Geologist, representing the North Carolina Geological Survey. Mr. Keith and Mr. Gale have devoted especial attention to the study of the geological structure and history of the region, while Dr. Pratt and the State Geologist have examined more carefully the economic geology and miscellaneous mineral resources.

Dr. Pratt, with the assistance of Prof. J. V. Lewis, has practically completed the preparation of the report on corundum and its associated rocks and minerals; and the State Geologist has nearly completed a report on the mica deposits. Mr. Keith and Mr. Gale have continued their work of mapping the geological formations, and several of the atlas sheets, embodying all available information concerning these and the mineral resources and water-powers of the region, are now being prepared for publication.

TOPOGRAPHIC SURVEYS.

A considerable amount of topographic work has been done by the United States Geological Survey, co-operating with the State Survey, both in the eastern and in the western counties. In the western counties a considerable amount of work has been done in connection with the topography and forest conditions, with especial reference to the creation there of the Appalachian Forest Reserve. A considerable amount of topographic work has also been done in the eastern portion of the State, especially in the vicinity of Newbern, Trenton, Edgecombe, Rocky Mount, Tarboro, Kenly and Hertford.

These maps of the eastern counties are engraved on a scale of one mile to the inch and with contour intervals of ten feet, so that they have a degree of accuracy considerably beyond that of ordinary topographic atlas sheets. The contour lines show the elevation of the surface at different points above tide-water, the scale of the map will indicate the distance, and the contour lines will indicate further the feasibility of drainage of the land. These maps will be used as a basis not only for locating the geological formations, but also as a basis for the examination and classification of the soils of the region and a study of the under-ground water conditions.

OYSTER AND FISH INVESTIGATION.

The oyster examinations and the general biological survey of the eastern sounds which were begun in October, 1900, through an arrangement of co-operation between the United States Fish Commission and the State Geological Survey, have been continued at intervals during the past year. The observations on the oyster beds which were planted during these examinations in the vicinity of Beaufort have been continued during the summer season by Dr. Caswell Grave of Johns Hopkins University, who was associated with this work during the preceding year. During the months of June and July, Dr. Grave was assisted in this work at intervals by Dr. Glaser of Columbia University, and by Dr. Graham of the University of Alabama. Dr. Grave will continue his investigations of the oyster beds in the vicinity of Beaufort during the summer season of 1902, and at the end of that season his report and also the report of the Fish Commission experts, who have been co-operating in the examination of the oyster beds in Eastern North Carolina, will be published by the Survey.

The establishment of the Marine Biological Laboratory at Beaufort and of the Fish Hatchery Station at Edenton will greatly facilitate the general investigation of the biological conditions of the Eastern North Carolina sounds, and it is hoped that these investigations will lead to results of great benefit in connection with the development of the oyster and general fishery interests of the State.